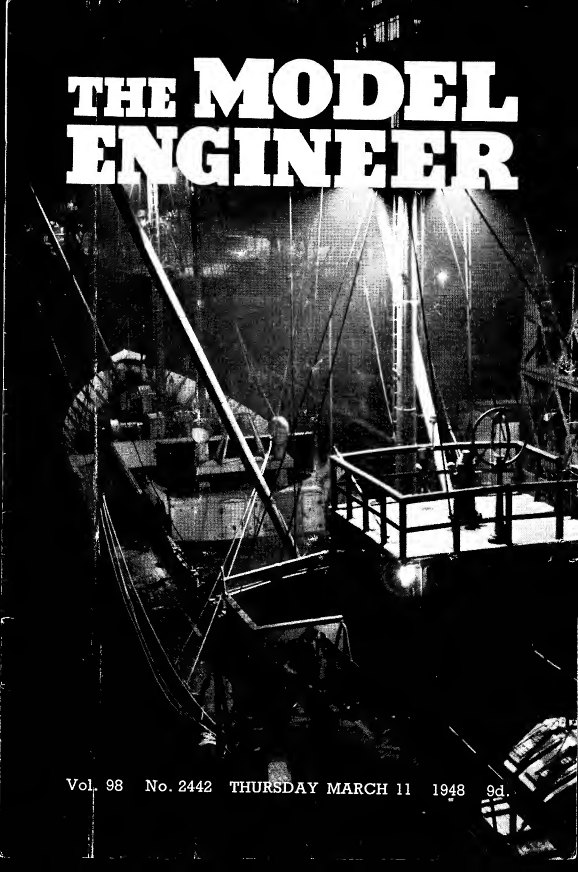
THE MODEL ENGINEER



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The MODEL ENGINEER

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SMOKE RINGS

Our Cover Picture

● THIS WEEK we have reproduced a photograph of a dockyard scene taken at night-time and illuminated by the floodlight used for night work operations. In all the ports of Britain, at the present time when the export drive is making heavy demands upon the capacity of our docks and shipping, such scenes are commonplace.

The Glad Hand in New Zealand

● THE CHIEF engineer of a large steamship, while in a New Zealand port, met an acquaintance who, finding he was interested in models, said "If you are in Dunedin, drop in on Les Scott." A little later, this chief engineer, Mr. W. F. Jacobs, M.I.Mar.E., found himself in that port, and, remembering his friend's advice, paid the visit as directed, and now tells me what happened. He writes :—"When in New Zealand some eight months ago we discharged part cargo in Dunedin. I walked into the business of Mr. Les Scott and had a most welcome reception. He invited me to his home in the evening where I had a most interesting look round his well-fitted workshop, with a goodly number of models around. Mrs. Scott gave me some delightful coffee and home-made cakes of a kind I have not seen here for some years. The next day I had the pleasure of showing Mr. Scott, his son, and a friend all over the vessel of which I was Chief." And so the glad hand of model engineering is extended the wide world over. Mr. Les Scott is well known in New Zealand for his excellent model making, examples of which, including a fine marine model, have at times been illustrated in our pages. Mr. Jacobs has a warm remembrance of his welcome from the Scott family. He is due to retire shortly after his 25 years service as Chief at sea, a record not without its unpleasant interruptions from enemy submarines, and is looking forward to some quiet hours in his workshop. He says "My interest in all engineering will be sustained as far as I can tell, and I hope to be able to read THE MODEL ENGINEER as long as I live." Many happy years to you, Mr. Jacobs.

Model Engine Assembling

● OUR FRIEND Mr. Percival Ward Wilson of Ohio, who has had a life-long experience of the erecting of both real marine engines and of his own excellent models, sends me the following observations arising out of my recent note on this subject. He writes :—"I duly noted your remarks under the caption of 'Smoke Rings' in a recent issue of THE MODEL ENGINEER regarding the number of times a model engine has to be pulled apart and reassembled during the process of building. Perhaps the marine-type vertical, with its inverted cylinders is the worst offender. Then there are the drawings, some are clear while others are not. Then there may be an over zealous desire to follow the prototype

to too great a degree of refinement, only to find out later that there are *snags* in the way. A straightforward design, the simpler the better, with all parts accessible or as far as possible so, would tend to eliminate the above-mentioned pulling apart and reassembling. A careful study of the drawings in conjunction with a plan of operations in carrying out the work, and *following* said plan should be helpful. The eagerness to see the engine partly erected is common to most of us, even though we know that we shall have to take it apart again. In big practice they cannot *profitably* indulge in this sort of thing, so they don't do it! They usually have a set price for the job and precious little margin to work on, hence planning and *sequence* of events receive close attention as does past performance in building *similar* engines or machines." All of this, from an old hand, shows how much unnecessary putting together and taking apart may be avoided by good drawings to start with and a little careful planning as the work proceeds.

A Club for Chichester

● IT IS proposed to form a model engineering club for both seniors and juniors in the Chichester area of Sussex. Mr. T. T. Page of 21, Cambrae Avenue, Chichester, has the matter in hand, and would be pleased to hear from any local readers who are interested.

To Newton Abbot Readers

● MODEL ENGINEERS in the Newton Abbot district are interested in forming a local Society and have asked Messrs. J. Scott-Browne (N.A.) Ltd. to assist them in getting started. This firm will be pleased to receive names and addresses at their office at 51, Queen Street and to help in any way to bring local enthusiasts together.

Steam Engine History

● A MOST interesting contribution to engineering history has reached me from Mr. Ronald H. Clark, son of the late Mr. H. O. Clark, that most energetic collector of old-time engineering models. Mr. Ronald Clark shares his late father's enthusiasm for steam engine history, and is a particular student of everything relating to traction engines. He has now put some of his patient research into book form under the title of *Steam Engine Builders of Norfolk*. The work is published by the Augustine Steward Press, Tombland, Norwich, price 5s. 6d. It is a fascinating record of the productions of engine building firms in Norfolk of whom thirty-one were at one time in active operation, but of these only three now remain in the engine building field. Although traction and portable engines were the outstanding manufactures of most of these concerns, their contributions to steam engine history included horizontal engines, beam engines, marine engines, showman's engines, steam cars, and even a locomotive, the "Gazelle," of standard gauge. This was built in 1896 at the works of A. Dodman & Co. Ltd. of Kings Lynn, and was of the 2-2-2 type. It was probably the only standard gauge locomotive ever to be built in the county of Norfolk, and after some local running subsequently did good passenger service on the Shropshire and Montgomeryshire Light Railway. Another interesting old-timer described in this book is a steam brougham built by Mr. H. A. O. Mackenzie of Scole which first appeared on Norfolk roads as long ago as 1874. It carried four passengers, and at a speed of from 10 to 12 miles an hour, had a running record of some hundreds of miles to its credit. A feature of Mr. Clark's book is the wide range of illustrations of engines of all types of which there are no less than sixty-eight, and these in themselves form a notable contribution to the history of steam engineering and a striking tribute to the author's painstaking research. Steam engine lovers owe a debt of gratitude to Mr. Clark for his most attractive and informative record of a phase of engineering ingenuity and enterprise which, unfortunately, is rapidly becoming only a memory, though full of richness in ideas and achievement.

An Old Model Yacht Club

● I RECENTLY enquired in these columns if any club could beat the record of the Tynemouth Model Yacht Club whose history goes back to 1893. This has brought a reply from Mr. D. A. Ripley on behalf of the Bradford Model Yacht Club founded in 1886 and still one of the leading clubs. Bradford has fine sailing water on Larkfield Tarn at Rawdon, a boat house, and ample accommodation for the comfort of members at the sailing meetings which are held on alternate Saturdays. There is no provision for power boat members, and this is no doubt due to the fact that the older model yacht clubs were founded before the power boat era, although Tynemouth serves the double interest. Yacht sailing and power-boating are really two distinct hobbies and they do not mix very readily except in the use of a common sailing water by mutual arrangement.

Model Engineering is Different

● A CORRESPONDENT, G.F.A., puts his finger on an aspect of model engineering which I am sure will be appreciated by many of our skilled readers. In his daily work he has access to the most up-to-date machine tools and workshop equipment—in his "den" at home he carries on with a very modest outfit of tools and materials. He has to approach his machining problems from a very different angle, scheming how to do this or that job in an effective but perhaps a roundabout and much slower fashion. Yet he enjoys every moment of his model making, for as he says:—"I find the biggest 'kick' in our hobby of model engineering is the using of one's simple tools in so many ways. This encourages initiative and assists to make our hobby so interesting and a relief from the worries which surround us today. I sincerely believe that if one has all the tools one requires, model making loses its interest and becomes a repetition of one's daily work."

Percival Marshall

A Gauge "1" Electric Locomotive

by Victor B. Harrison

MY younger son and I were so delighted with the success of the electrification of a portion of the "Hurst Central" railway and the running of the loco and the train, that we visualised it being added to and improved.

The loco was most useful for shunting purposes and undoubtedly an improvement on the controlled clockwork locomotives, as it saved any amount of running in and out of the shed when getting trains out of sidings or marshalling them. If in a hurry and no visitors are present, hand power is often used.

I got very busy laying third-rail in all the sidings. This job gave one a bit of a headache at crossovers, especially where there were slips. In two cases in the terminus the shoes on the loco lost contact, and if one were not watchful the loco stopped. This, undoubtedly, was due to the automatic braking of the permanent magnet motors. Knowing this, one was inclined to put on more speed in order to avoid this contretemps, with the result that a wagon or coach was often pushed off the rails; also, the overhang of this engine was not exactly ideal when pushing coaches or wagons round sharp curves. Therefore, my son and I decided that, if we were definitely going to use the electrical installation for shunting, a suitable loco would have to be constructed. I had in my possession an excellent booklet on the German electric locos, but there was not one that took our fancy. The Swiss ones too, would, in the model, suffer from too much overhang. The only possible way was to make a replica of the goods engines brought out by Maerklin in "O" gauge. Unfortunately, the catalogues in which it was depicted did not show sufficient detail, so, at the time, it looked as if we would have to shelve the matter. Then, out of the blue, a friend who had heard of our plans sent me full particulars of both the new S.R. and the L.N.E.R. mixed traffic engines. These both looked ideal. The S.R. had two six-wheeled bogies with a single pantograph and, also, collecting-shoes.

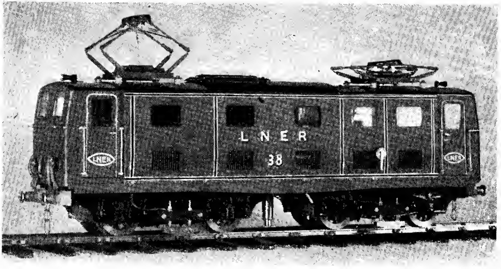


Photo No. 1 The completed engine

The L.N.E.R. was a two four-wheeled bogie job with two pantographs but no collecting-shoes. The latter omission did not worry us; but what did finally make us decide on the L.N.E.R. was that the buffer-beams were on the bogies and not on the frames. That obviously would minimise the chances of buffer-locking when pushing a train round "S" curves. At the same time, Messrs. Bonds were offering for sale a surplus stock of 24-volt shunt-wound electric motors which I believe were used by the R.A.F. In these motors, one of which is shown in Fig. 1, the driving-shaft projected on either side of the motor, which was just what we wanted. I purchased one of these motors and then got out the drawing board.

The length of the engine in gauge "1" worked out to $18\frac{1}{2}$ in. long and $3\frac{1}{4}$ in. wide. First I designed the bogies; the wheels are $1\frac{1}{2}$-in. diameter, which is rather on the large side; but, nevertheless, everything seemed all in proportion when compared with the small

line-drawing in the paper cutting and the two photos of the engine. When I drew in the body it did not look quite so good, but I discovered I had not drawn in the side frames of the chassis, when I had done this, all looked perfectly O.K.

I then placed the motor on the drawing to see how it fitted in. All seemed well until I realised that room still had to be found in the roof of the body for the retracting solenoids of the pantographs which required quite another ½ in. above the motor. The obvious solution was to sink the motor into the floor of the chassis but, unfortunately, there is only ¾ in. between the bogie frames in the centre of the chassis. So, on the face of it, the gaining of that half-inch seemed a hopeless proposition; so I shelved the proposition and decided to get on with the bogies. I had by me the pattern of the tender wheels of my Great Western single, which was correct, both in appearance and size.

As soon as the gearing was completed on the one bogie, my son and I were both impatient to see how the chassis bogies and the motor would behave on the track. We made a clamp to secure the motor in position on the chassis, and one of the discarded pantographs was rigged up by means of blocks of wood and fastened to the chassis. The result was a marvellous-looking "Heath Robinson" affair. The universal joint between the motor and the projecting driving shaft on the bogies was made with a spring, wound out of some piano wire. All this was done in a fearful hurry on a day when it had stopped raining and the sun had come out. While I was putting finishing touches to the contraption my son was busy in the railway shed getting the new motor generator temporarily connected up so that we could make a test.

As no collecting-shoes had yet been fitted, the test had to be carried out on the overhead section. We were both interested to see what

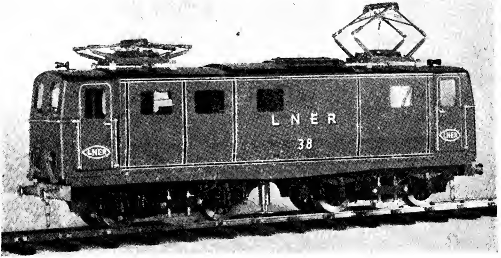


Photo No. 2. Another view of the completed engine

Then came the merry old imp, frustration, who is so much in evidence at the present time, and said "I cannot let you have any castings made." I tried in vain but a friend suggested using the small wheel of the 2½-in. gauge "Dyak." The size was correct but not its appearance. I had no alternative, so I purchased some of these castings. When my son came home he worked hard for two week-ends to get all eight wheels turned and mounted on axles. As the motor did 3,000 r.p.m. it was decided to gear the drive down to 4-to-1. The first step was a 2-to-1 skew-gear on the axles and then a further 2-to-1 in spur gearing. The two axles were coupled together by a 5/32-in. steel shaft, and the gears themselves in little gear-boxes. I made it on the same principle as I used on the "Courtice Control Coach," which allowed for a certain amount of articulation. The springing of the bogies was done by springing the bolster, as will be seen in Photo 5.

the condition of the track and the overhead was after having been out in the rain for nearly two months without being used. When I carted out the contraption, my son had got everything fixed up and had tested everything and reported that both the Swiss loco and the S.R. train did their stuff in the Central Station. The chassis was put on the rails where the overhead line began, I gave my son the "right away" and, as soon as he moved the controller, off she started, but in a most sedate manner. My son reported that the controller was set at full speed; but, nevertheless, the chassis proceeded at only a steady scale of 15 m.p.h. We stopped her and examined all the connections, but could find nothing wrong, we let her continue on her way. I did notice, then, that there was a fine "November 5th" display at the wheels. She proceeded all the way round at the sedate speed, and we let her come to rest when she left the overhead at the entrance of the branch station.

As the reversing-gear was not yet fitted I had to turn the chassis round. The return trip was a pleasant surprise. She started off in great form. Apparently, the first trip round had cleaned the track sufficiently to enable the motor to get the benefit of the full voltage. We did several trips backwards and forwards, and, on one trip, my son pulled the controller full over

showed how nicely she can be controlled. When the engine arrived at "Lone Pine," my son brought her to a standstill at the back of the train without moving it. I am sure the passengers felt no jolt at all!

At the end of the return journey, we nearly had a terrible disaster. At about 10 ft. before the end of the overhead system, current was

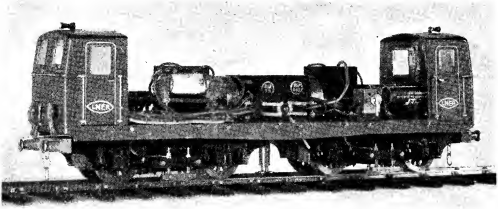


Photo No. 3. The central body removed

and off went the chassis like a scalded cat. I shouted to my son to ease off as otherwise she would have jumped the track at the first curve. Undoubtedly, the 4-to-1 gearing was not low enough.

Fortunately, my method of mounting these gears enabled me to fit two more bearings on the two uprights, and they will be seen in Photo 5. This was an advantage, as it made the drive at a less acute angle. At the same time, I fitted two brass flywheels to the shaft on either side of the motor to give the engine more momentum, so that she could more easily negotiate the gaps in the third-rail at Central Station.

At the first opportunity, we tested the engine again. This time the motor was properly fixed in its position and a universal joint was fitted between the bogie and the motor. This time there was a general improvement all round. She moved off very smoothly, and when current was switched off, she rolled a considerable distance and slowly pulled up. Also, at full current, she ran at a nice steady speed. We decided that it was worth while attaching a train. As no draw-hook had yet been fitted to the buffer-beam, I hastily improvised one out of a piece of wire. A four-coach train was attached and away she went in style. The coaches made no difference to her speed and there were no signs of slipping in spite of using only one bogie for driving.

When this weird train arrived at "Lone Pine" my son stopped her. This had the result of uncoupling the train and, on restarting, the engine came back on her own. I was going to carry her back and couple her up again but my son insisted on sending her round again and so make her push the train back. This manoeuvre

switched off. At the time, the train was travelling at full speed and the result was that engine and train continued their mad career, the coaches slowly drawing away from the engine. As I was outside the shed I was keeping my eye on the engine and forgot about the carriages. If I had not stopped the engine, the pantograph would have been smashed at the tunnel entrances My son realised in time the speed of the coaches and grabbed them just in time, as otherwise they would have severely damaged themselves and also probably smashed the shutter at the other entrance. I made a better coupling and we had two or three more runs when it started to rain and so put an end to our experiments for the day The generator performed perfectly, and, as for the engine, matters looked very promising as regards performance.

The problem of the housing of the solenoids for retracting the pantographs had to be faced. Definitely $\frac{3}{8}$ in. had to be found somehow or other. I very carefully examined the underneath of the chassis and found that it was possible to lower the motor by about a full $\frac{3}{16}$ in. I dismantled the chassis so as to have the floor-plate without any encumbrances. I screwed another plate underneath the floor about $\frac{1}{4}$ in. larger than the hole that would have to be cut in the floor. I drilled the fixing-holes for the motor-bolts through this plate, using the original holes as jigs. I then unscrewed the plate and, with a fret-saw, cut out the hole in the floor-plate; after making the 12 distance-pieces out of $\frac{1}{4}$-in. round rod, I screwed the whole back into position. All this took time, but it turned out a most satisfactory job.

(To be continued)

*Swords into Ploughshares

Hints on the adaptation of "surplus" war material for model engineering or utility purposes

More about Electric Motor Conversion

by "Artificer"

As already mentioned in the first article in this series, many readers are interested in the possibility of converting "surplus" motor generators and similar machines to run as motors on mains voltages, and a number of experiments have been made with this end in view. The results have been somewhat mixed, for whereas some types of machines have been found to answer the required purpose quite well, others of apparently similar design and rating have failed to do so, and there appear to be no consistent or recognisable features which will enable one to determine whether or not a particular machine is capable of conversion, other than by actual test. Some machines may be converted in a matter of a few seconds to run off either a.c. or d.c. mains; others will only run on d.c., or strangely enough, only on a.c. supply; while others again may call for more or less extensive alterations to connections or windings. All of which is very confusing; and while it might be possible to establish definite rules in this matter by careful study of the characteristics, including the resistance and impedance of the windings, and salient features of design, of the various types of machines available, there are so many of them that this would be a colossal task.

It may be mentioned that a good deal of correspondence has been received from readers on this matter, including reports of both successful and unsuccessful experiments. As these results, generally speaking, agree with those obtained by the writer, there is little to be gained by quoting any of them individually; but due acknowledgment is made to all readers who have contributed in this way to the experimental data so far obtained.

The class of machine which appears to offer the best prospect of being convertible without a great deal of trouble is that known variously as a "motor generator," "rotary transformer" or "dynamotor"; its originally designed purpose is to produce high-voltage direct current from low-voltage direct current input, for the purposes of h.t. supply in radio or radar equipment. This type of machine is used in cases where low voltage supply is readily available, as in aircraft installations. In other cases, double-wound d.c. generators, driven by mechanical power, are employed; and although many of these appear to be almost identical in electrical design to those in the previous class, they do not appear to be so well suited to conversion. One possible reason for this is that mechanical generators must be so designed that some residual magnetism is left in the field-magnet when the machine is not in use, which is unnecessary and possibly even undesirable in a generator having the field electrically energised. A few machines have been encountered in which d.c. input is converted to a.c. output, and these obviously cannot be converted to run as ordinary mains motors.

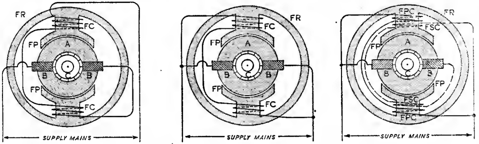


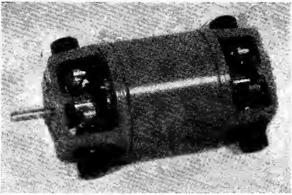
Fig. 1. Methods of connecting windings of dynamos and motors. (Left) series; (centre) shunt; (right) compound. A, armature; B, brushes; C, commutator; FR, field ring; FP, field pole; FC, field coil; FPC, field parallel coil; FSC, field series coil

Working Characteristics of Motors

It is not within the scope of this series of articles to go deeply into electrical theory, and any reader who is completely in the dark as to the working principles of dynamos and motors will find this subject fully dealt with in any standard text-book on electricity and magnetism. However, a brief review of the characteristics of these machines will be found helpful in understanding the reasons for the different behaviour of motors or dynamos which are wound or connected in various ways. As in other matters which have been discussed in these articles, it may be necessary to apologise to the more

*Continued from page 219, "M.E.," February 26, 1948.

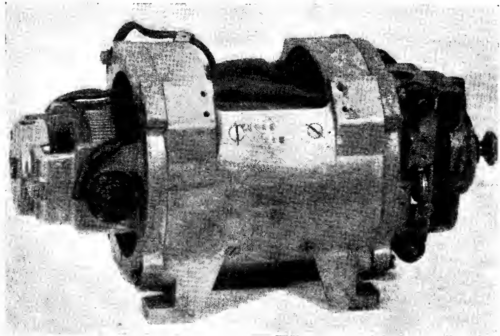
erudite readers for the elementary treatment of the subject, but all that is attempted is to consider its practical application to the particular problem in hand. Motor and dynamos of the type we are considering are similar in design, and to some extent interchangeable in function, so that what applies to one may, in certain cases, also apply to the other.



Motor generator by Hoover; input 11.5 *v., d.c., output* 490 *v., d.c. Runs well as motor on* 200-230 *v., a.c. or d.c.* (*Submitted by D. R. Welch & Co. Ltd.*)

The armature of a motor must be designed in such a way that it can deal with rapid changes of magnetic flux, as the various coils of the windings are continually changing polarity, being connected to the source of supply through the brushes and the commutator. With d.c. supply, the flow of current through the field windings is steady and unidirectional so that rapid changes of flux do not occur; but if the supply is a.c., conditions will be entirely different, and it is clear that a field-magnet which is suitable for a d.c. machine will not necessarily be equally applicable to an a.c. machine of similar input voltage. It is in this respect that the differences

In the normal form of electric motor, mechanical motion is produced by the interaction of electro-magnetic effects in both the field and the armature. Machines designed specially for use on a.c. differ considerably from those designed for d.c., but there is an intermediate class—almost identical in their general or superficial design to d.c. machines—which will run on either a.c. or d.c., and are known as "universal" motors. It is with motors of this class that we are chiefly concerned.



Large motor generator (make unknown); input 24 *v., d.c.; output* 1,250 *v., d.c. Runs well on* 200-230 *v., a.c. only, developing approx.* ⅛ *h.p.* (*Submitted by Douglas Holt Ltd.*)

in the characteristics of the motors for the two different sources of supply are most pronounced. A d.c. motor will run with a field magnet of solid iron, but in an a.c. motor, it is necessary to use a laminated field, built up from thin sheets of

soft iron or special high-permeability alloy, to avoid the magnetic losses and heating effects which would otherwise be produced in a solid iron mass by the rapid changes in magnetic flux.

But this is by no means the only difference in a.c. and d.c. motor characteristics. Even with the most efficient form of laminated construction, a considerable amount of electrical power is absorbed in changing the polarity of the field magnet 50 times a second (which occurs in a motor running on a.c. 50-cycle supply), and this produces a choking effect, or "impedance," which acts in much the same way as

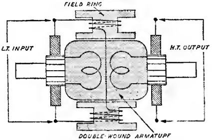


Fig. 2. Wiring diagram of motor generator for low-voltage d.c. input and high-voltage d.c. output

extra resistance in the circuit. Thus a motor with a laminated field, designed to run on d.c., might be quite unsatisfactory for use on a.c. because the impedance would prevent sufficient current from flowing through the magnet to energise it efficiently.

Back E.M.F.

It has already been noted that the functions of a motor and a dynamo are to a great extent interchangeable. That being so, it is easy to see that when a motor is running at high speed, its armature is actually generating electricity, which as it happens, is in the reverse direction to that of the external source of supply, and is known as the "Back Electromotive Force." It is this effect which sets a limit on the speed which a motor can attain, by restricting the input current, and serves a useful purpose by preventing it from racing at a dangerous speed when the load is removed. Motors intended to run at very high speed, such as vacuum-cleaner motors, are designed to produce a low back E.M.F. Both a.c. and d.c. motors are subjected to this effect, though not necessarily to the same degree.

The working characteristics and current flow in electric motors are thus influenced by various factors, including (1) the resistance of the windings as measured by ordinary static tests, usually known as ohmic resistance; (2) Impedance of field and armature windings; (3) Back E.M.F.

Shunt and Series Characteristics

The field and armature windings of a motor or dynamo may be connected in either of three different ways, i.e. shunt, series or compound, each of which produces distinct characteristics in the working and current flow (Fig. 1). In a shunt-wound machine, the field and armature windings are in parallel circuits, each connected directly across the input terminals, and therefore virtually independent of each other in respect of current flow. Series-wound machines, on the other hand, have the field and armature windings connected end to end, and the current flow in one winding is limited by that in the other. The compound-wound machine embodies the features of both types, but is not usually found in the smaller sizes of motors and need not be considered in detail.

Shunt-wound machines tend to run at fairly constant speed for a given input voltage, irrespective of load, because the field strength is constant, and governing is obtained by rapid rise in back E.M.F. when the speed tends to rise. The torque is fairly constant, and under overload conditions, or starting under load, may be inferior to that of a series motor. Speed regulation is best obtained by a variable resistance in series with the field winding only; an increase in this resistance lowers the field strength, and thereby *increases* speed by raising the limit at which back E.M.F. takes effect.

Series-wound machines are best suited to working at constant load, as the torque varies widely according to speed, and they are only self-governing to a very limited extent, but they have a very powerful starting torque and do not readily stall when overloaded. Speed control is usually obtained by means of a variable resistance in the input circuit, but this is not the best possible method, as it very much reduces maximum torque and wastes current. A better, but possibly less convenient method of control is by voltage regulation, such as by using a "potential divider" or other variable-voltage input device.

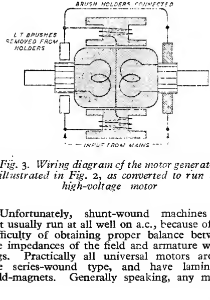
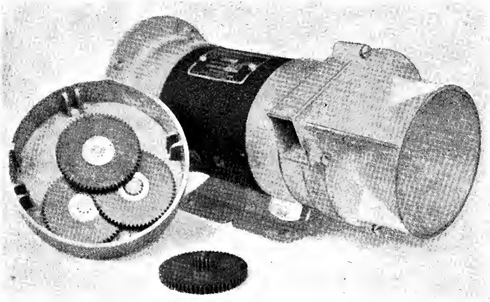


Fig. 3. Wiring diagram of the motor generator illustrated in Fig. 2, as converted to run as high-voltage motor

Unfortunately, shunt-wound machines do not usually run at all well on a.c., because of the difficulty of obtaining proper balance between the impedances of the field and armature windings. Practically all universal motors are of the series-wound type, and have laminated field-magnets. Generally speaking, any motor

conforming to this specification, which will run on a.c., will also run on d.c., though the current consumption may be excessive, and heating may occur, because impedance effects are reduced. The reverse, however, does not necessarily apply, and there are some outstanding and not readily accountable exceptions to these rules. It is therefore impossible, from a superficial examination of a machine, or study of its those designed for low-voltage d.c. input, from about 9 to 24 volts, and high-voltage d.c. output, from about 200 to 450 volts. This type of machine is shown diagrammatically in Fig. 2. Conversion consists simply of changing over connections, so that the low-voltage armature winding is completely open-circuited, and the field winding (usually shunt-connected to this winding), is then put in series with the high-voltage winding



Dynamotor by the Wincharger Corp. (U.S.A.). Input 9 v., output 450 v. Runs well as motor on 200-230 v., a.c. This machine is equipped with a multi-range reduction gearbox and a centrifugal blower. (Submitted by Mr. Hogben)

general specification, to say with absolute certainty how it will behave under given conditions of supply or duty.

Although the provision of a more or less powerfully magnetised field—either by a permanent magnet or an exciting coil—is generally considered essential in both dynamos and motors, it is possible to run a motor fairly efficiently with a very weak field, and examples have occurred of machines having a soft-iron field carcase and no field windings, which run by virtue of magnetism induced from the armature windings.

It is thus clear that there are infinite variations possible in the design of either dynamos or motors, and success depends on a very delicate balance of various characteristics, some of which may be susceptible to exact rules of design, but others can only be arrived at by experimental research. That being so, it would appear that the successful adaptation of a machine to a purpose very remote from that for which it was designed, and in some cases to work on a totally different voltage, must be very largely a matter of luck.

The machines which have been found capable of conversion with the minimum trouble are of the armature. In most cases this alteration can be effected by simply removing the low-voltage input brushes and connecting one input brush holder to one output brush holder, the other two brushes being then connected to the supply mains, as in Fig. 3. The machine then functions as a series-wound motor with a weak field.

Several advertisers in THE MODEL ENGINEER have carried out conversions of this nature on machines found to be suitable, and are prepared to guarantee that the results are satisfactory. Readers who wish to find out for themselves whether any particular type of machine can be converted, are cautioned that haphazard experiments with the supply mains are somewhat risky, and would certainly be frowned upon by the electricity supply authorities; but it is possible to adopt safeguards, such as local fuses and current limiting resistances in the circuit, which will prevent any possibility of short-circuiting the mains. The use of a transformer is recommended in any experiments made with a.c. mains, as this not only avoids the above risks, but also isolates the test

(Continued on page 274)

A Toolpost Grinder for Five Shillings

HAVING obtained a bargain lot of H.S.S. milling cutters with taper shanks nearly but not quite No. 1 Morse taper, the need for a grinding attachment made itself felt, as the shanks of these cutters were so hard that a carbide-tipped tool made little impression on them.

Accordingly, a tradesman's type bicycle hub (front) was bought for 5s., dismantled, and the bearing cups knocked out. The hub was then brazed on to a piece of 2 in. by ½ in. section M.S. (scrapbox) of a length suitable for the top slide, drilled for the toolpost stud, and suitably contoured at the end (using a boring bar between centres) to fit the hub body.

The hub should be wired securely to the M.S. block when brazing, as, of course, it is necessary to have the hub spindle in line with the lathe centres when grinding. The hub was re-assembled, and a considerable wobble was apparent on the spindle. Two new cones were then turned, and screwcut from M.S. rod and casehardened, and all assembled again.

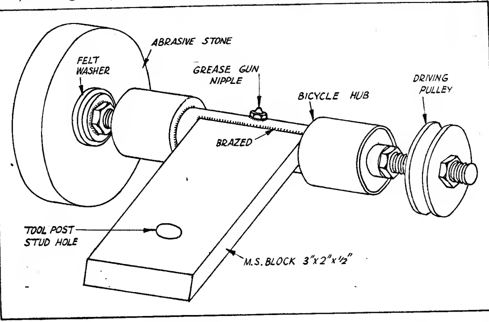
A small " V " pulley for one end and a couple of large-flanged and recessed nuts completed the gadget. Need I mention that the good old scrapbox once again provided these items ?

The drive is from the lathe countershaft *via* spring-tensioned jockey pulleys and round belting, an arrangement already in existence for use with a home-made milling head for the lathe.

I was very sceptical about this bicycle hub grinder, as it is a somewhat light affair, but in practice it has proved O.K. for light cutting.

The abrasive wheel is 4 in. diameter, and driven at 5,000 r.p.m., and with the cutters rotating at 600 r.p.m. between centres, I ground six to finished size in an hour, that is, of course, after the top slide had been set to the required angle. Cuts of 0.005 in. are all right on this diameter of job, and the finish, taking a 0.002-in. cut, is first class.

Great care must be taken to lock the adjustable cone tightly after final setting, as a seize-up with a 4-in. stone running at 5,000 r.p.m. would be no fun.



The spindle is only ⅜ in. diameter, but in spite of this, and the fact that the stone is mounted 2 in. from the hub bearing, the thing is quite sound for light work. In fact, most folk, like myself, will find that only light cuts *can* be taken, because of the fact that the driving motor is quite fully loaded at that, in driving both grinder and lathe. (Writer's motor is ¼ h.p.)

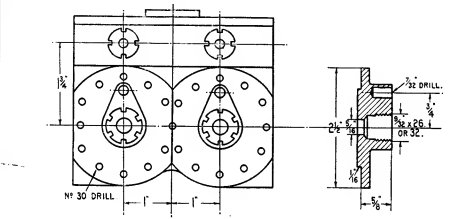
The oil hole in the hub should be tapped ¼ in. B.S.F., and a motor-cycle grease gun nipple fitted (I've fitted these to every part of my lathe, also bench grinder, etc., as it's a grand way of ensuring freedom from grit in a bearing ; the fresh lubricant goes in with tremendous force, taking all before it. I forgot to add that I turned up a large pulley from hardwood to fit the countershaft, and to provide the necessary increase in r.p.m. for the grinder.

All slides must be adjusted stiffly when the attachment is used, and there must be no slackness of fit between the job and the lathe centres if chatter is to be avoided—a strong watchmaker's eyeglass being a valuable thing for detecting this, as well as for general model-making use.—T. P. ARNOTT.

Cylinder Covers for "Minx"

by "L.B.S.C."

THE accompanying illustrations show the difference between the back covers of the cylinders for the "Minx," and those already given for the "Maid." By using a single overhead guide-bar, same as on "Petrolea," we get over both the difficulties of the restricted space between the leading axleboxes, and the small clearance between the leading axle and the piston-rods. Instead of the usual stunt of having a flat seating over the gland boss, and screwing the guide-bar to it, I am specifying a hole in the boss directly above the piston-rod; and if the end of the guide bar has a spigot turned on it, for pressing into the hole, it will make a much more substantial anchorage for the bar, than any bolt arrangement. On top of that, if the hole is drilled as specified in last week's instalment—that is, with the covers in position on the cylinder-block, and the job done by aid of drilling machine or lathe—the bars absolutely can't help being square with the covers and parallel with the piston-rods. Inspector Meticulous might probably argue that it isn't according to full-size practice; but I might inform that merry old gentleman that it *would* be, if it suited the size of the locomotive. That is the rub! As I've tried to point out time and time again, and repeat for the benefit of beginners, I follow the example of full-size locomotive engineers by designing and building my locomotives to suit the width of rails they will run on, and the job they are intended to do. Where big practice is suitable for small practice, I copy "big sister." Where it doesn't, I substitute something, or some method, that is more suitable for the small size of the engine. Conversely, you could oil up my "Tugboat Annie," for example, with a fountain-pen filler—one of those weeny glass tubes with a nozzle at one end, and a rubber teat at the other; but a fat lot of good that would be for the 4-ft. 8½-in. "Duchess of Wigan" or "King Wenceslas." Might as well try to feed an elephant with a baby's bottle! Incidentally, somebody once said that no full-sized locomotive engineer ever used screws with slotted heads; only hexagon heads. Well, that's all they know; there were plenty of them around our cab windows! Also, all our donkey pumps had screwed glands, not studded glands; why? Simply because screwed glands were more suitable for the small size of the donkey pump!



Back cylinder covers for the "Minx"

The covers can be machined and fitted exactly as described in the last instalment. The only difference is in the marking out of the holes for the guide-bars. Lay the cylinder casting, with covers attached and the little centre-plug in the stuffing-box, on its side, instead of port-face down; set your scribing-block needle to the centre of the plug, as before, and scratch a line along the single-sided boss. Set your divider points ¾ in. apart, and strike off the intersection at the upper end of the gland boss. Drill the holes as mentioned above, and you're all set.

Steam-Chest

Anybody who has a four-inch or larger four-jaw independent chuck, can set up the steam-chest in that, and machine off both contact faces by aid of a round-nose tool set crosswise in the rest. It is my own pet procedure, and I prefer it to milling, as it is much quicker. I should then grip the casting by the contact faces in the machine-vice on the miller table, and mill off both sides

and the front end where there aren't any bosses. They could be milled in the lathe, by bolting to the slide-rest or saddle, and traversing across a big end-mill, or a facing-cutter, as described recently in the "Workshop" articles, see page 113 of January 29th issue. By the way, the tool shown on page 115 is the same as I have described and illustrated for saddling the bases of chimneys, domes, safety-valve casing and so on, except that for these jobs it needs a round nose ; and I can testify to its usefulness.

You won't be able to face off the boss-side, and turn the bosses, unless your lathe will swing a good 3 in. over the bed, or has a wide gap. My Milnes would do it easily, so I should grip the casting in the three-jaw by one of the bosses, set it to run truly, and then make a centre-hole at the opposite side of the steam-chest with a centre-drill in the tailstock holder, repeating operations on the second boss. Both bosses would then be centre-drilled, marking them out carefully and doing the job on the drilling-machine. The steam-chest could then be run between centres, each boss turned, and the metal between the bosses and at each side of them, nicely faced off. The ends of the bosses could also be faced almost to the centre point.

I should then drill out the centre holes in the bosses, on the drilling-machine, the casting being held in the machine-vice and set truly vertical by aid of a try-square ; but if your drilling-machine is too small, or you haven't one, the jolly old lathe can be pressed into service once again. Talk about a jack-of-all-trades, or a maid-of-all-work ! Well, put a $\frac{3}{16}$-in. drill in the three-jaw, place the boss against it, run up the tailstock until the centre point enters the centre-hole opposite the boss you are going to drill, and go ahead. The drill can't very well help going through truly and square ; for, unless the lathe is an absolute dud, the drill will line up with the tailstock centre which is holding the steam-chest at the correct angle. The holes should be opened out with an 11/32-in. pin-drill, to ensure the glands being concentric, and tapped $\frac{3}{8}$ in. by 32. Hold the tap in the three-jaw and support the chest by the back centre whilst you tap the holes by pulling the lathe belt by hand, back and forth.

If your lathe won't swing the steam-chests to turn the bosses and centre the opposite ends, don't worry ! File the sides and ends of the steam-chest by hand, centre-pop the bosses, and set out the centres opposite to the two bosses, by carefully measuring and centre-popping. Put the centre-drill in the three-jaw, hold the steam-chest against it, with the point of the centre-drill in the pop-mark, then run up your tailstock and enter the point in the pop-mark in the boss. Turn the hand-wheel, and the centre-drill will do the rest. Ditto repeato on the second centre, then reverse the whole bag of tricks and centre-drill the bosses, afterwards drilling and tapping for glands as above. The glands themselves are turned down from $\frac{5}{8}$-in. round bronze rod, or from castings. They should be $\frac{3}{4}$ in. long overall, to provide plenty of bearing surface for the valve-spindles, as these engines have no tail rods. Set out and drill the screw-holes as shown in the drawing published two weeks ago, using No. 30 drill. Take care not to break into the stuffing boxes.

Separate gland bosses have been specified for some of my $2\frac{1}{2}$-in. and $3\frac{1}{2}$-in. gauge engines, and they can be used on these two 5-in. gauge jobs if desired. In that case, the steam-chest would be cast as a plain rectangle. Set out the location of the valve-spindles on one of the long sides, after the casting has been machined on contact faces and on the outside ; drill $\frac{1}{8}$-in. pilot-holes, checking off to see if they are true. Then open out with $\frac{1}{2}$-in. drill. Chuck a bit of $\frac{5}{8}$-in. round bronze rod in three-jaw ; face, centre, and drill $\frac{3}{16}$ in. for 1 in. depth. Open out with letter R or 11/32-in. drill to $\frac{11}{16}$ in. depth, tap $\frac{3}{8}$ in. by 32, and part off at $\frac{7}{8}$ in. from the end. Reverse in chuck and turn down $\frac{3}{8}$ in. length to a tight fit in the hole in the steam-chest. Repeat operation, squeeze in the two bosses, and silver-solder them. Alternatively, the holes in the steam-chest can be tapped with any fine thread available, the shanks of the bosses threaded to suit, and screwed tightly home.

Steam-Chest Cover and Centre Fitting

The steam-chest cover may be either a casting, or a piece of $\frac{3}{16}$-in. brass or copper plate measuring $4\frac{1}{8}$ in. by $3\frac{1}{4}$ in. in which case, it won't need any machining. If a casting is used, a spigot may be provided for gripping in three-jaw whilst the contact face is machined off ; or the cover may be held in four-jaw, same as the steam-chest itself. Cut off the spigot after it has served its purpose ; reverse the casting and re-chuck (using the four-jaw and setting it to run truly), centre it, drill a $\frac{9}{16}$-in. hole in the middle, and face off around the hole to a little over $1\frac{1}{8}$ in. diameter. This forms a true seating for the blastpipe flange.

Next, clamp the cover to the steam-chest, and drill all the holes for the fixing screws, using those in the steam-chest as guides ; then make the centre fitting. Chuck a piece of 1-in. round rod in three-jaw ; face, centre, and drill down about $1\frac{3}{4}$ in. depth with $\frac{3}{8}$-in. drill. Turn down $\frac{3}{8}$ in. of the end to $\frac{9}{16}$ in. diameter, and screw $\frac{9}{16}$ in. by 26 or 32, or any other fine thread for which you have the necessary tackle. Part off at $1\frac{9}{16}$ in. from the end ; reverse in chuck, and turn down $\frac{5}{16}$ in. of the other end to $\frac{9}{16}$ in. diameter, screwing it to fit the tapped hole in the middle of the port-face. File or mill away the centre portion at each side, to bring the width down to $\frac{11}{16}$ in. so that the slide-valves can operate at each side of it ; see cross-section of cylinders. A casting may be available for this gadget, and if so, it can be drilled and screwed same way ; the flats will be cast on and only need cleaning up with a file. Screw the fitting into the hole in the port-face, with a smear of plumbers' jointing on the threads, and make certain the flats are parallel to the sides of the steam-chest.

The flange, or seating, on top of the steam-chest is merely a circular nut, and can be made from a stub of $1\frac{1}{8}$-in. brass rod held in three-jaw. Face, centre, drill and tap to suit thread the at top of centre fitting, and part off a $\frac{3}{16}$-in. slice ; or maybe a casting will be provided, in which case machine it like a cylinder cover. A couple of flats can be filed on the edge, at opposite sides, for turning it with a spanner, or you can drill a couple of holes

in it, and turn it with a prong wrench, as preferred.

Put the steam-chest in place and drop the cover on top of it, the hole in the middle of same going over the top of the centre fitting. Put on the flange and screw it just finger-tight, which will hold the chest and cover lightly. Now adjust both chest and cover till they line up at both ends and both sides with the cylinder casting, then tighten the flange down to prevent them moving. Run the No. 30 drill through all the holes in cover and steam chest, making countersinks in the port-face. Remove chest and cover, drill the countersinks No. 40, and tap $\frac{1}{8}$ in. or 5-B.A.; then when you put your screws or studs in, you'll be certain that everything fits and lines up O.K. Studs are best on an engine this size; they are simply pieces of $\frac{1}{8}$-in. round steel $1\frac{7}{16}$ in. long, with $\frac{3}{16}$ in. of thread at one end, and $\frac{5}{16}$ in. at the other. The shorter end is screwed into the cylinder casting, as shown in the longitudinal section. Ordinary commercial nuts will do for fitting to the studs.

Valve, Buckle and Spindle

Castings will be supplied for the slide-valves, with the exhaust cavity cast in, which will save a lot of trouble. They can be machined up exactly as described for the bogie axle-boxes, with an end-mill in the three-jaw; if the castings are clean, they may only need smoothing with a file. Have the overall length and width about right; and face them truly, first rubbing on a smooth file laid on the bench, and then on a piece of fine emery-cloth or similar abrasive, laid with its working face upwards, on something perfectly true, such as surface-plate, or drilling-machine table, or the lathe bed.

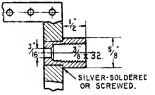
The valve buckles will also be castings, and all they will need, will be filing carefully on the inside of the rectangle, so that they fit easily, but without shake, on the valves, and the boss drilling and tapping to accommodate the spindle; see illustrations. Use 5/32-in. drill, and tap $\frac{3}{16}$ in. by 40; make sure that the hole in the boss is drilled truly, or the buckle won't sit squarely on the valve, and will pull it off the port-face, and let steam blow past. If you have no drilling-machine, use the lathe; hand work isn't good enough for a job of such importance.

The valve-spindles are $2\frac{1}{2}$ in. lengths of $\frac{3}{16}$-in. ground rustless steel or drawn bronze rod screwed $\frac{3}{16}$ in. by 40 at each end. One end is screwed into the buckle as shown. The cylinders may now be temporarily assembled ready for erection, putting a couple of screws in each steam-chest cover, to hold same in position, and about four in the steam-chest and cover. Our next job will be to fit the guide-bars and crossheads.

An Economical Injector

As most folks who follow these notes are well aware, I always aim for the maximum amount of work with the minimum of steam consumption; and to that end have recently been trying some more experiments with injector cones. I fitted a set to one of my "standard" injector bodies, and put it on old "Ayesha" for a test at the first opportunity. It so happened that two old friends Mr. Traylor and Mr. Gosden, came to see me on the afternoon of January 31st last. The former party you have met before in these notes; the latter used to be manager of the local Morris motor depot, to which a person known as Jerry subsequently paid a visit, with the usual result. He is now partner in a repair garage, and is building a Boston and Albany 4-6-6 tank engine in the small amount of spare time available. The rain keeping off for a little while, we steamed up old "Ayesha" and tried the injector. It worked all right, feeding the boiler, running or standing, without any effect on the steam gauge; but it inadvertently had a test which I think is worth recording, as I have never had the same experience on so small a locomotive. If anybody comes off the road, the flanges of the car wheels usually damage the sleepers, tear out a few screws and break the washers, and I invariably have to do a bit of p-way repairing if anybody "goes loopy." Bearing this in mind, Mr. Traylor was so intent on keeping his balance that he not only omitted to shut the fire-hole door, but let the fire get very low, also the water; and when he stopped there was only 40 lb. on the "clock," about $\frac{1}{8}$ in. of water showing in the glass, and just enough fire to cover the bars.

I shovelled in a few midget black diamonds, opened the blower and proceeded to fill up the water tank; then, as the fire immediately had started to liven up, and the injector will start readily at 40 lb., I put it on. Not only did it not reduce pressure, but the boiler began to make



How to fit separate gland bosses to steam-chest

steam against the injector feed; and as the water climbed up the gauge glass, the needle of the steam gauge had also started in the right direction. By the time the water reached to top of the glass, the safety-valve started blowing off! Had this occurred on a 5-in. gauge engine, or even a modern type of $3\frac{1}{2}$-in. gauge locomotive with an efficient boiler, it would have been nothing to write home about; but bear this in mind — it happened on a 26-year-old engine with a boiler only 3 in. diameter and a grate $2\frac{7}{8}$ in. long! Everybody who has driven old "Ayesha," or even seen her at work, knows that the boiler is a good steamer, like all my engines; but a boiler that size, picking up from low steam, low water, and a "black" fire, against a little injector going all out, is, I fancy, good evidence that the injector works with about the absolute minimum of steam consumption. I should not have recorded it—no need to ask why!—if two reliable witnesses had not been present; and as explained above, the test was quite "impromptu." Eh—what's that? I haven't given details of the cones? I know—just wait awhile. There are lots of surprises still up Curly's sleeves!

Early Passenger Hauling

The note by "H.J.H." on the above subject in the issue for January 15th last needs a little qualification. The late Mr. Tom Averill was my friend; we corresponded right to the time of his decease, and shortly before that sad event, he sent me an injector body and asked me to fit a set of cones to it, saying his lathe was rather clumsy for the job. I fitted them, and he wrote that the jigger was O.K. and said he would send me some rose trees, as I was fond of flowers, but the Reaper stepped in. I still have some of his letters. He was confidential, and told me the whole story of his locomotive building; he was very sore about the way his ideas had been barefacedly annexed and "commercialised." He definitely *did* prefer the loco.-type boiler to the water-tube pattern, and said more than once that if he had known of my methods of boiler construction at the time he built his engines, he would have used them. His trouble was what I have often mentioned in these notes, viz.—riveted-and-soldered joints and tubes leaking through expansion cracks.

Mr. James Carson also told me about the ten-stone load one of his engines shifted, but said the effort was too great, and the engine could not pull the load continuously; otherwise it would have been mentioned in the catalogues, in place of the "small boy load" illustrated. Carson's never claimed more, in the way of performance, than they could guarantee, which was more than could be said of other firms of even date.

When the single-cylinder locomotive mentioned by "H.J.H." hauled, not a live load, but *one solitary coach* for a mile, and then had to "slip" that to finish the run, it was hailed as a marvellous performance. Now the significant point is, that somebody who claimed to have had a ride behind this, or a similar engine, was one of the first to ridicule the idea of a $2\frac{1}{2}$-in. gauge "Atlantic" *with greater cylinder* capacity, hauling a living load. Had he actually ridden behind the engine as claimed, he would have known that I made no idle claim, and would not—after I had proved my contentions in public—have derided my engine as a "specially hotted-up freak." Speaking of freak performances, it would be quite possible to make an engine of the "Ajax" type do a spot of freak passenger hauling; all it would need, would be a strong boiler, and a few bits of lead at the back to weight it down. By letting the engine stand until she accumulated about 100 lb. pressure, she would start a twelve-stone load, thus beating the Carson effort; but like the latter, couldn't keep it up, and would stop after a few yards run. There is a vast difference between *starting* a load, and *running* with it; or in other words, between "freak" and "consistent" performances. An engine that won't "keep on keeping on," is of little use!

It may interest "H.J.H." to know that I have a book called *The Young Engineer*, written by Hammond Hall and published in 1908. Opposite page 140, there is a photographic illustration showing a $3\frac{1}{2}$-in. gauge Midland type 4-4-0 with cylinders $\frac{5}{8}$ in. by $1\frac{1}{4}$ in., and a spirit-fired water-tube boiler, with a youth sitting behind it on a flat car, in a rather uncomfortable position. The caption says, that is how the engines are tested. The passenger is a bigger boy than in the Carson picture, but it is a bigger engine. Reference is made to the picture in the text; but it distinctly states that *the engine could not be expected to do the job continuously, without suffering in the process.* Old "Ayesha," now in her 26th year, thinks nothing of doing $1\frac{1}{2}$ miles non-stop around my road with three adults—*verb. sap.*!

Summing up—if there were any solid foundations for the various claims for early passenger-hauling, other than those I quoted, why was I universally called a you-know-what, and challenged to prove my own contentions in public? The answer is obvious!

Swords into Ploughshares

(*Continued from page 269*)

circuit in the event of earthing the live leads.

To the many readers who have asked whether it is a sound proposition to purchase one of these "conversions" now offered for sale, for driving a lathe or other machine tools, the answer is simple. If the machine produces the power required, and will run continuously under normal load for, say, two hours, without excessive current consumption, sparking at the brushes, or overheating, there is no reason whatever why it should not continue to give good service indefinitely. The mechanical construction of these machines, in nearly all cases, is excellent, and the electrical winding and insulation is generally better than the normal commercial standards for mains motors. In common with all other commutator motors, they may give rise to radio interference, which may be dealt with in the usual way, by the fitting of a "suppressor" unit across the h.t. brushes.

In passing, mention may be made of the usefulness of some of these motor generators for producing a supply of low voltage current suitable for workshop and laboratory use, including battery charging and circuit testing. Although built for low-voltage input, many of them can be fed from the high-voltage end to produce low-voltage current; only d.c. supply can be used, but the very small amperage required can easily be obtained through a metal rectifier. One of these machines examined embodies a triple winding, with three commutators, for voltages of 24 (normal input), 200, and 13.5; it has a permanent magnet field, and thus no alteration in connections is necessary to run it on the mains; the centre pair of brushes is simply connected to the supply leads. Current consumption is less than 50 milliamperes. This machine forms part of a transmitter power pack, comprising many other useful components, in a metal case, and is offered very cheaply by the Aero Spares Co., of Church Street, Edgware Road, and High Holborn, London.

(*To be continued*)

A Flexible Drive Shaft

by J. W. Tomlinson

THE electrically-driven flexible-drive shaft can prove to be one of the most useful pieces of equipment in the model engineer's workshop. The ingenious methods employed in making use of this equipment, and the large amount of accessories available, make it a universal tool and one that every model engineer should possess.

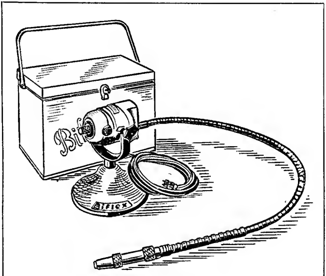


Fig. 1. *The "Biflex" two-speed* 1/3 *h.p. machine*

The type of equipment suitable for this type of work is described in this article together with a few of the methods used by the author. No doubt this will start a train of thought in the minds of fellow model makers, resulting in fresh ideas on how to use this equipment, to suit the particular work they have in hand.

The Machine

The machine shown in Fig. 1 is the "Biflex," and it is made by B. O. Morris of Coventry, and although they offer a large range of machines, the "Biflex" is particularly suitable for the model engineer. The machine is a two-speed model, giving 1,600 and 9,600 unloaded r.p.m. and approximately 950 and 7,000 under full load. The motor is 1/3rd h.p. universally wound, suitable for operation on d.c. and single-phase a.c. 25/60 cycles, and can be bought in the following ranges: 100/110, 200/220, 230/250 volts. The motor is mounted on a stand to give free movement, and the standard length of flexible drive is five feet.

Files, Cutters and Rasps, etc.

A large range of files, cutters, rasps, wire brushes, emery bobs, grinding wheels, polishing mops and sanding discs is available, and these are supplied in hundreds of shapes and sizes, making it possible to carry out all kinds of work. The rotary cutters are much used on aircraft work for cutting duralumin, aluminium, electron, and all kinds of non-ferrous alloys. The various tooth pitches are shown in Fig. 2. (A) is used on soft alloys when removing large cuts, (B) is the general purpose cut and is the standard tooth pitch, (C) gives a finer finish than (B), and (D) is a special cut for cast-iron.

For general work in mild-steel, stainless-steel and cast-iron, rotary files are used instead of cutters, and these can be easily distinguished by their cut. Three cuts for giving different finishes are shown in Fig. 2. Rasps are used for working in wood and other soft materials. These are supplied in two cuts, rough and smooth; an example of the rough cut is shown in Fig. 3. Cutters, files and rasps are supplied in dozens of shapes including tapers, cones, balls, domes and parallels amounting to hundreds of variations, some complete with spindles and others which screw on to the spindle, as shown in Fig. 3.

Wire Brushing and Polishing

So much for cutting tools; what about wire brushing, polishing and grinding? Quite a good appearance can be given to light alloy castings by wire brushing or scratch brushing as it is sometimes called. All types of wire brushes are supplied for this purpose and these are also useful for removing burnt oil and carbon from engine parts, and cleaning rusty surfaces prior to painting.

For emery polishing, felt bobs are supplied in various shapes, three of which are shown in Fig. 4. To these is glued a covering of emery powder, of a grain size to suit the job. The best way to prepare them is to first procure some good quality glue (the cold water type will do). Temporarily fit a bob to a spindle, and with an old paint brush give it a very even coating of glue, then roll the glued bob carefully in the emery powder. Allow at least 24 hours for the glue to set, and the bob is ready for use. When the emery has worn off, the bob can be re-coated after first chipping off any uneven patches of emery.

For a finer finish, polishing mops of various

diameters can be had, these are made up from layers of cotton cloth stitched together. Buffing soap is applied to the mop while being driven at high revolutions. The centrifugal force throws the layers of cotton cloth, forming a semi-rigid wheel, to which the job is lightly held. The job is finally polished by the application of chalk to the mop, in place of soap.

For polishing cellulose paintwork, super smooth polishing mops are supplied. These are often in the form of a lamb's-wool bonnet which is tied over a felt bob or disc. For polishing precious metals, gold, silver, etc., swansdown mops are used.

other small parts can be made. The arrangement can be constructed from materials at hand, making the centres and tool-rest adjustable, and various types of carriers can be made to suit any particular job.

Small jobs can often be shaped by simply fastening the drive in a vice and shaping the part

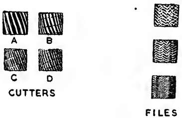


Fig. 2. Four tooth pitches of cutters and three of rotary files

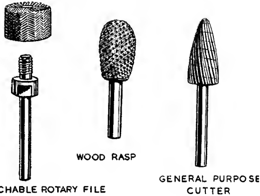


Fig. 3. Three types of cutting tool

By using these methods of polishing, the high-class finish seen on modern automobiles is obtained, and a well made model finished in this way looks superb. For grinding jobs, various types of wheels are on the list in numerous shapes and sizes, and whether it is a matter of grinding out a bore or sharpening a tool, the flexible drive shaft is your servant.

with a file. The part can then be brought to a high finish by holding it to a piece of emery-cloth. Small handles, knobs and ball-ends for controls can easily be made in this way. See Fig. 6.

Another use is shown in Fig. 7. To improve the appearance and lighten the finished model, it is usual to blend the castings to one another

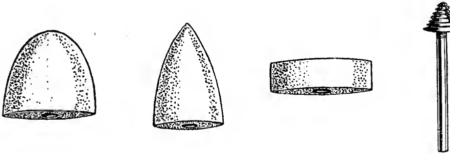


Fig. 4. Three types of felt bob with spindle

A Few Uses

A few of the various methods of using this equipment are illustrated. With each use these will vary according to the type of work to be done and whether other machinery is available. For instance, is a lathe is to hand there is no need for the set-up shown in Fig. 5. On the other hand, if a lathe is not available, quite a lot of useful work can be done with this set-up. The author saw all the turning done for a complete set of chessmen on an arrangement like the one shown, and they were a first-class job, too. Such items as the turning of model furniture, ship fittings and small wheels, and dozens of

after they have been bolted together. With the flexible drive they can be machined to perfection, leaving the same amount of metal around each boss, giving the job a look of good workmanship and balance. To improve the finish still further, the machined profile can be run round with the emery bob. When carrying out this kind of work, the drive shaft must be held firmly, the proper grip is shown in Fig. 7. This correct grip will prevent the cutter running away, and since the cutter tends to run from left to right, due to direction of rotation, when machining close to a joint face the cutter should be held so that if it did get out of control for a second or two,

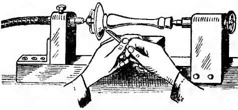


Fig. 5. *An arrangement for wood turning*

it would run away from, and not on to the joint face. For small jobs a general purpose cutter will do for this kind of work, running the drive at high speed.

Quite a simple grinding-head can be formed by securing the flexible drive to the tool-post as shown in Fig. 8. This can be used for grinding out small cylinder bores, and although it is more or less an improvisation, a good job can be

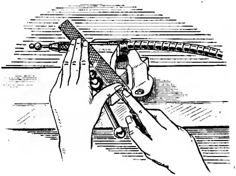


Fig. 6. *Shaping small parts*

made if care is taken. The drive shaft will, of course, be in top gear for this operation, and it is important that it is fastened securely to the tool-post.

Another purpose for which the drive can be used is shown in Fig. 9, that of cutting discs and washers. The tool shown can be made from square stock mild-steel for the holder and softened square files suitably bent and ground

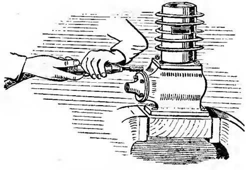


Fig. 7. *Profiling small castings*

for the cutters. The holder can be slotted to take two cutters, and by fixing them together in the holder at different radii, it is possible to cut washers in one operation.

For grinding small tools the flexible drive is very handy, the drive being simply held in the vice as shown in Fig. 10. Top speed is used for all grinding operations, and chisels and

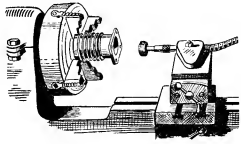


Fig. 8. *A set-up for bore grinding*

drills can be sharpened quite easily. It is possible to sharpen taps by grinding the flutes, but this operation requires a fair amount of skill and a suitable grindstone.

Fig. 11 shows a model being finished by polishing the cellulose paint. This can be done by tying a lamb's-wool bonnet or a piece of basil over a felt bob. Pumice powder is used as a

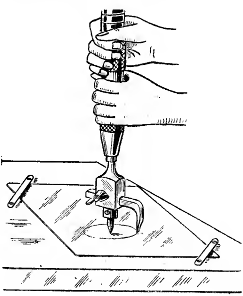


Fig. 9. *Cutting discs*

polishing medium. Basil is a very soft form of lambskin, much used for polishing silverware. The final polish is given with an application of chalk or Sheffield lime.

For polishing non-ferrous metal parts, cotton or calico mops are used, in most cases the drive

can be fastened in the vice and the work held to the mop, or if the job is large, the drive can be held and manipulated round the job. For polishing ferrous parts, fibre brushes make a better job, these are used in conjunction with buffing soap and finishing with chalk or Sheffield

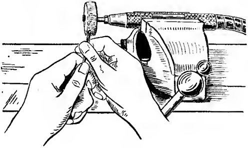


Fig. 10. *Grinding small tools*

lime. Buffing soaps are generally made of Tripoli earth with a grease bond, or lime and grease, the latter type of soap must be kept dry.

These are just a few of the many uses to which the flexible drive can be put, and the more one handles the tool, the more uses can be found for it, until it becomes a pleasure to use and almost indispensable.

Maintenance Notes

With care the equipment will last indefinitely. The motor bearings are packed with grease, and, normally, will run for years without attention. Provided the drive is treated properly, this also will last a long time. Periodically the drive should be unscrewed from the motor, and about a thimbleful of oil poured down between the inner and outer cable. The drive should then be left suspended to allow the oil to run the full length. The inner cable should not be swamped with oil, as any surplus will work through the outer cable in the form of a black swarf. Another point to watch is not to bend the drive acutely when in use, as this will put an undue strain on the inner cable, which may eventually lead to overheating and breakage. Hand-guards should always be fitted, more especially at the working end. These are flexible coil strengthening-pieces which fit over the outer cable at each end. These prevent ill treatment by way of twists and sharp bends, and form a standard part of the equipment.

Precautions

The usual precaution should be observed as with any electrical machine working off high voltage. Frayed and badly fitted leads should

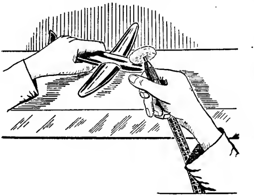


Fig. 11. *Polishing cellulose paint*

not be tolerated. Long hair and loose neckties should be kept well clear of the business-end of the drive. The motor should be properly earthed and the lead should not be allowed to get twisted, trapped or wound around other adjacent machinery or tools.

For the Bookshelf

Diesel Model Engines, by C. E. Bowden. (London : Percival Marshall & Co. Ltd.) 160 pages, size 7 in. by 5 in. Fully illustrated. Price 5s. net.

This book has been produced at a time when the miniature compression-ignition engine is engaging the attention of many constructors of model aircraft, speed-boats and racing cars, and the author is a well-known enthusiast whose method is to acquire practical knowledge through constant and painstaking experiment. The text is essentially readable and deals not only with elementary and fundamental features of C.I. engines, but, also, with innumerable applications of these little engines to many different types of model. Of particular interest are the descriptions of practical tests made on certain miniature C.I. engines against comparable petrol engines, the results of which are illuminating if not absolutely conclusive. The captions to some of the illustrations reveal a regrettable want of care in editing ; for example, in Fig. 71 the field gear referred to is obviously on the left and not on the right, while the caption to Fig. 81 is decidedly open to question. At the author's special request, we have been asked to state that he is indebted to The Harborough Publishing Co. Ltd. for the use of some of the illustrations. These errors and omissions should be corrected in future editions ; in other respects, the book is a most useful treatise on a popular subject,

IN THE WORKSHOP

by "Duplex"

6—Lathe Chucks

IN writing this article dealing with lathe chucks it is fully realised that readers with workshop experience will already be familiar with the subject; but, on the other hand, there are many, for the most part newcomers, who are not so fortunate, and it is rather for them that these notes are intended.

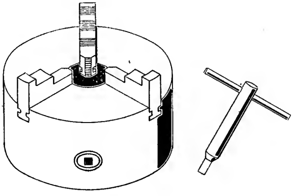


Fig. 1

Both the mandrel of the lathe headstock and the tailstock spindle can be fitted with chucks suitable for holding material or tools, as may be required, in either of these situations.

Two different types of commercially made chucks are available for attachment to the screwed mandrel nose of the headstock, namely, the self-centring and the pattern with independently operated jaws, known as the independent chuck.

The Self-Centring Chuck

A typical example of the three-jaw self-centring chuck is shown is shown in Fig. 1. Usually, two sets of jaws are supplied with this chuck; those shown in Fig. 1 are termed outside or lathe jaws, and those in Fig. 2 inside or drill jaws. These jaws are provided with teeth on their inner surface which mesh with the spiral thread on the front of a scroll housed within the chuck body.

When this scroll is rotated by means of a pinion gear operated by the chuck key, the jaws are caused to open or close on the work as required. It might be thought that a chuck of this kind would hold the work exactly true, but unfortunately this is not the case, and an error in this respect amounting possibly to some three thousandths of an inch may be expected, although many chucks hold the work more truly than this.

As the accurate cutting of the teeth on both the jaws and the scroll is a difficult mechanical operation, and as, in addition, these parts may be distorted during the hardening process, it will be appreciated that perfect accuracy is not possible and some errors will almost certainly be encountered. As the scroll is provided with a working clearance to allow it to revolve on the central boss, it follows that it may be pushed aside by the operating pinion used to tighten the chuck jaws on the work; it is for this reason that in some makes of chucks one particular key slot is marked, and this should always be used when an accurate setting is required.

Some difficulty may be experienced by novices in replacing the jaws correctly to give the self-centring action, and to facilitate this the jaws and their seatings are numbered as shown in Fig. 2. Furthermore, the jaws must be engaged with the thread of the scroll in the proper order, usually 1, 2, 3, but sometimes this is not the case and the order of engagement must be determined by the appearance of the jaw teeth, as represented in Fig. 3. It will be apparent that the first jaw to be inserted has its first tooth nearest the tip or point of entry, and in the

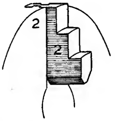


Fig. 2

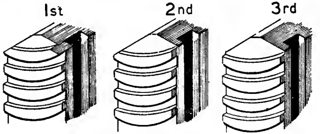


Fig. 3

third jaw this is the most remote. When fitting the jaws, always make certain that they engage the start of the scroll thread correctly and without forcing the scroll, otherwise the threads may be damaged. If in a new chuck a jaw is found to be a tight fit in its seating and does not readily yield to finger pressure, it is better to tap it *very lightly* with a rawhide hammer to ensure that it beds on to the scroll, rather than to risk doing damage by forcing the

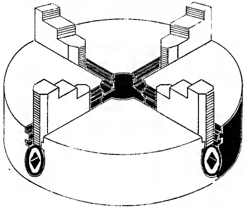


Fig. 4

chuck key. To facilitate the rather tiresome operation of changing the jaws of a self-centring or other key-operated chuck, a short length of square steel should be gripped in a woodworker's brace and used instead of the chuck key, or this piece of material can, if desired, be permanently fitted to a discarded brace made for changing car wheels.

Other varieties of self-centring chucks are in general use: the brass-finisher uses a two-jaw chuck, and the clockmaker employs a light type of six-jaw chuck in order to distribute the pressure when holding delicate work. For light work and to minimise overhang, the pinion gear operating the scroll may be dispensed with, and instead the scroll is turned by means of a tommy-bar inserted in a hole in the periphery.

This form, which is known as the lever scroll chuck, as opposed to the other variety, the geared scroll chuck, has the additional advantages of light weight and relatively small cost.

The Independent Chuck

This chuck, illustrated in Fig. 4, usually has four jaws which, as its name implies, can be adjusted individually by means of a key. The chuck body is provided with four tenoned seatings, in which the jaws slide under the control of the four adjusting screws operated by the chuck key. As in this case ordinary square screw threads, and not a scroll, are used on both the adjusting screws and the jaws, the latter can be reversed if required, and only one set of jaws is needed for both inside and outside holding. A well-made chuck of this pattern can be adjusted to hold work with great accuracy, and, as may be remembered, the method of setting work with the dial test indicator was fully explained in a previous article.

A variant of the independent-jaw chuck is found where the lathe face-plate is fitted with dogs or removable screw-jaws, which are adjusted in the same manner as in the previous type.

The Combination Chuck

This chuck which has three or four jaws combines the properties of both the self-centring and the independent chuck, but it is rather expensive and its greater overhang is a further disadvantage.

Here, as in the self-centring chuck, the base portions of the jaws are moved simultaneously by a gear-driven rotating scroll, but, in addition, these jaws are provided with secondary sliding jaws which can be adjusted independently by means of a chuck key. It will be apparent that when adjusted to hold a piece of material truly, this setting is preserved when the scroll alone is used to reclamp this or a similar piece of work, but, if material of a different size is mounted in the chuck, the independent jaws may have to be reset to correct any error of holding arising from any slight inaccuracy in the scroll.

Collet Chucks

Fig. 5 depicts an example of a collet chuck, and Fig. 6 shows how it is usually fitted to the hardened steel mandrel of a precision lathe.

Where, as in the ordinary lathe, the mandrel is not hardened, the collet chuck can be housed in a special hardened adapter fitted to the mandrel nose. As will be seen, the collet is split longitudinally for the greater part of its length along three lines equally spaced at 120 deg.; this allows the chuck to contract and grip the work as the draw-bar pulls the coned nose into the corresponding coned recess in the mandrel.

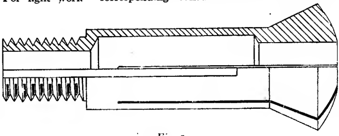


Fig. 5

As these collets are hardened and ground to very fine limits, they will hold with great accuracy, but their range of holding extends to only a few thousandths of an inch above or below their nominal size.

Any attempt to grip work of greater or less diameter than is provided for in this small range of action may damage the chuck and render it unfit for further accurate service. Likewise, gripping hexagonal or square-rod must on no

account be undertaken, but special collet chucks made for this purpose may be used if required. To get the best results with chucks of this type, only ground-rod or accurately turned parts should be used in conjunction with them.

Drill Chucks

Chucks for holding drills, or other small tools, are fitted to the lathe tailstock to enable work mounted on the mandrel to be drilled with a stationary drill, which is accurately held and centred by this means.

The most popular forms of chucks used for this purpose are those of the Almond or Jacobs pattern illustrated in Fig. 7, which are made to accurate limits and usually hold true to within a thousandth of an inch. As will be seen in the drawing, a toothed key is used to turn the outer knurled gear sleeve, which in turn causes the three jaws to open or close as they slide in their guide-ways formed in the chuck body.

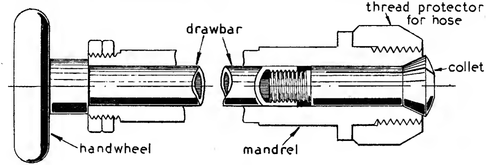


Fig. 6

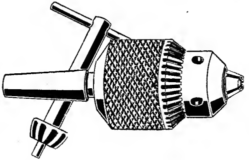


Fig. 7

Although these chucks can be supplied with a screw-threaded base, they are usually made with a coned recess at the base to enable them to be mounted on a double-tapered arbor as depicted in Fig. 8. The larger tapered portion of this arbor is usually of standard Morse taper for fitting into the corresponding taper in the tailstock spindle.

The Morse taper arbor can also be used to mount the chuck in the lathe mandrel, but in this case, if it is used to hold parts for turning, it should be secured by means of a draw-bar to prevent its loosening. Likewise, if there is any danger of the chuck loosening when mounted in the tailstock, it can be secured by a short draw-bar passing through the hollow tailstock spindle.

As a means of affording additional security, the chuck may, if desired, be fixed to the arbor by means of a screw inserted through the base from within, as shown in Fig. 9.

The arbor, while mounted in the lathe mandrel taper, is drilled and tapped to receive the 4-B.A. fixing screw.

A piece of rod is then fixed in the lathe chuck and turned true ; to this the drill chuck is clamped by means of its jaws with the base outwards ; a No. 24 drill is then run right through the base of the chuck, and this hole is tapped 2 B.A.

The chuck can now be secured to the arbor by means of the 4-B.A. screw, and furthermore, it can be readily removed without risk of causing damage, if, after withdrawing this screw, the 2-B.A. screw is inserted and turned with a screwdriver.

In this connection it may be mentioned that it is always a wise plan to arrange whenever possible for machine parts to be dissembled and reassembled by screw pressure rather than by hammer blows. In a drilling machine built by the writers this 4-B.A. screw is also used to withdraw the ball-bearing thrust-race from the drill spindle, an operation which would otherwise

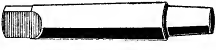


Fig. 8

cause considerable difficulty if damage were to be avoided.

Some manufacturers equip their lathes with a drill chuck of $\frac{3}{8}$ in. capacity of the Almond pattern screwed directly to the mandrel nose, and, as there is a clear way through the chuck when fitted in this way, it is useful for turning operations on rods and round bars.

The adapter illustrated in Fig. 10 carries at one end a replica of the lathe mandrel nose, and at the other a Morse taper spigot. This enables

chucks normally attached to the mandrel to be mounted on the tailstock spindle.

Mounting Chucks on the Mandrel

Now that the various patterns of chucks have been described, it is time to consider the workshop methods involved in fitting self-centring and independent chucks to the screwed mandrel nose, but before going further, it should be emphasised that if the chucks selected are supplied and fitted by the lathe makers prior to delivery, the work will be accurately and inexpensively carried out, for they have the special tools and gauges required to facilitate this work, as well as mechanics accustomed to the job. Nevertheless, there will be some who prefer to do the work themselves, or who wish to fit a chuck purchased at a later date.

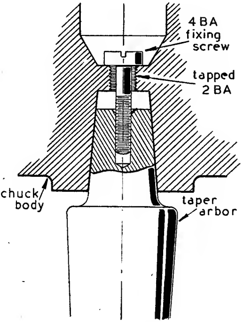


Fig. 9

When a self-centring or independent pattern chuck is obtained from the tool vendor, the fixing screws will be included but not the back-plate shown in Fig. 11.

The back-plate, which should be an accurate fit on both the threaded and plain portions of the mandrel nose, carries on its outer face a register boss to engage the recess in the back of the chuck and thus accurately locate it. Although the more practised workers may buy a plain back-plate casting and do all the machining required to fit it, others with less experience will, perhaps, be well advised to purchase the casting ready machined to fit the mandrel nose of the lathe. The former will not be in need of advice, and it is to the latter group that the following suggestions are offered.

On receipt of the machined back-plate, carefully clean the threaded portion with an old tooth brush and petrol, or paraffin, and after applying a little thin oil try the casting on the mandrel to make sure that it fits firmly but without the use of force. Then again clean the bore and apply some marking compound evenly to the flat face of the mandrel register shoulder; screw the plate in place, and after removal, examine its register face to make sure that it has bedded properly against the mandrel shoulder, as shown by the even distribution of the transfer marks.

If this is not the case, the back-plate must be lightly hand-scraped until uniform contact is established.

If this fitting is not carried out in the first place, and contact between the parts is irregular, with very little wear, the back-plate, and with it, the chuck, will alter position and untrue running will result.

Reference to Fig. 11 will show that the chuck face through which the bolts pass, termed the bolting face, is in contact with the back-plate, but on the other hand, the back-plate register is given ample end clearance.

To fit the chuck to the back-plate, mount the casting on the mandrel nose, and with the back-gear engaged, face the bolting face and the face of the register. With the aid of outside and inside callipers turn the register nearly to size, but leave it full length. Make use of the unwanted portion of the register as a trial-piece to fit firmly into the chuck recess, and when the correct setting of the cross-slide has been found in this way, turn the register to size throughout its length, then face off the register to give the required clearance at the bottom of the chuck recess.

It now remains to fit the fixing screws, which in the case of the independent chuck are usually inserted in the front face, and pass right through the body and so into the back-plate, but in a geared chuck the scroll is in the way and the screws enter the chuck bolting-face from the back.

In the latter case, the chuck should be dissembled by removing the body fixing-screws, thus gaining access to the tapped holes of the back-plate fixing screws, but before taking the chuck apart make sure that the two halves of the chuck body are marked so that they can be reassembled in the original position. Fit the chuck to the back-plate and secure it in place with two clamps to prevent unwanted movement, then, with the back-plate supported on the drilling-machine table, enter a well-fitting drill through each screw hole in turn, and drill a deep impression to serve as a guide when completing the drilling Mark the back-plate and the chuck for future reference during assembly, and then remove the back-plate. In the case of the self-centring chuck, the screw holes are now drilled to allow ample clearance for the screws and thus avoid their binding in the back-plate. The fixing screws of the independent chuck screw into the back-plate, so drill these holes tapping size, but open them out for a short depth to clearing size where they are in contact with the bolting face of the chuck, otherwise a burr will be raised

when tapping, which will prevent proper contact being made at the bolting face. For the sake of appearance, the back-plate is turned down to the same diameter as the chuck body after the parts have been bolted together.

If through access cannot be gained to the screw holes in the chuck to give guidance when drilling, the bolting face of the chuck is chalked; the parts are assembled, and the back-plate is lightly tapped. The transfer marks should then indicate

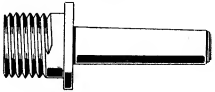


Fig. 10

the required positions of the screw holes on the back-plate. Alternatively, the position of the hole centres can be determined geometrically; the bolting face is painted with marking fluid and the pitch circle of the screws is scribed with jenny callipers from the register boss or from the periphery of the back-plate. The diameter of this circle is them measured and the dividers are set equal to its radius.

The circumference of the circle is now stepped round with the dividers, and any three alternate points are used as the drilling centres. Small errors arising during the marking-out will be of no consequence, for as previously stated ample clearance must in any case be given to these holes to avoid any possibility of the screws binding.

Care of Chucks

When mounting in the chuck, avoid doing so with the jaws nearly fully extended, for in this case the load will fall on one or two threads only, and these may be broken or distorted, thus rendering the chuck unserviceable. Never seek to obtain a firmer grip on the work by lengthening the key handle to obtain greater leverage; the makers know what the chuck will stand and fix the length of the key handle accordingly. Do not tighten the chuck unnecessarily, as this only wears the moving parts for no good purpose and may also distort the work.

Do not attempt to straighten or set work held in the chuck with hammer blows; this may damage both the chuck and the lathe mandrel as well as its bearings. When boring parts held in the chuck, where the bore passes right through the work, protect the internal parts of the chuck from the ingress of chips by means of a packing of rag or cotton wool. Chucks should be dismantled from time to time and thoroughly cleaned and greased, for if oil is applied to the working parts it will be thrown outwards by centrifugal force when the lathe is in operation. If any high spots are found on a stiffly working part in a new chuck, these may be slightly eased by the application of an oil-stone slip. When dismantling a chuck, make sure that all parts are marked so that they can be reassembled in their original positions.

Choice and Size of Chucks

When selecting chucks, always buy the best obtainable, and be guided by the maker of your lathe as to the type and size most suitable. Moreover, chuck manufacturers of repute, such as Messrs. Burnerd, will always be found most helpful in advising on the use of their products.

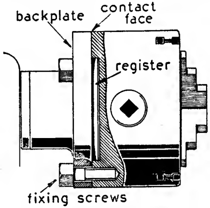


Fig. 11

A rough guide as to the diameter of chucks suitable for the lathe is to fit a self-centring chuck equal to the centre height of the lathe, and an independent chuck of one and a half times this dimension; thus a 3-in. lathe will require a 3-in. self-centring chuck and a $4\frac{1}{2}$-in. independent chuck, but if in doubt, err rather in selecting the smaller size so as neither to increase the overhang unduly, nor to impose an unnecessary load on a light mandrel.

Lathe Competition Result

As a result of readers' voting upon the three designs for lathes published in THE MODEL ENGINEER, we are now able to announce the result of the voting, which placed the lathes in the following order:—

First: Design by Mr. K. N. Harris.

Second: Design by Mr. Geater.

Third: Design by Mr. Williams.

This competition was sponsored by Messrs. T. Garner & Son Ltd., the well-known tool manufacturers of Barnsley, who awarded the prize money.

Editor's Correspondence

Hot-Air Engines

DEAR SIR,—I should like to thank Mr. J. B. S. Poyser for his kind remarks in your January 29th issue regarding my recent article on the hot-air engine.

The elliptical gear, the suggestion made by Mr. Poyser, would appear to be a good solution of the proposed variable velocity displacer drive. An engine so fitted would of course require *two* crankshafts—but the game might be worth the candle. I doubt whether a simpler drive could be introduced, and the slotted link system seems to call for a little consideration on the drawing board. It is difficult to visualise. There may be other suitable link mechanisms—but I cannot recall such. I cannot remember having seen an indicator diagram taken from an engine of the Stirling pattern, but it would compare very unfavourably, I surmise, with the usual kind of steam engine or I.C. engine diagram. Indeed, such a diagram would suggest very late *admission*, an early cut-off and perhaps a normal exhaust! And the result would take the form of the "hump" on the camel's back—or some approximately equivalent shape.

An improved means of operating the displacer, as discussed, should produce a very much more satisfactory indicator diagram—and if this not important it is nevertheless interesting.

Yours faithfully,

Montgomery. B.C.J.

Noise Suppression

DEAR SIR,—In reply to your correspondent, Mr. A. W. Feasey, who is in trouble with noise from his workshop in a modern flat, I would offer him encouragement from a somewhat similar experience of my own.

I live in a conventional semi-detached house of reasonably sound construction, and until recently my workshop was situated in a spare bedroom. When I first acquired a lathe some three years ago, I mounted it, together with a ½-h.p. motor and countershaft frame of angle-iron, on a stout bench specially built for the purpose. Soon after commencing operations I had complaints from the neighbours of a low insidious hum. On investigation it was found that the hum was very audible in certain parts of the adjoining house whilst it was completely inaudible in others. Since the workshop was against an outside wall it was concluded that transmission was taking place through the floor joists and party wall. The hum, of course, was coming from the motor, so this was first dismantled and the armature rebalanced. This effected a small but quite insignificant improvement.

The next step was to mount bench, lathe, and countershaft frame on hard rubber pads. Further, as the bench fitted into an alcove alongside a chimney breast it was braced against the wall on three sides by additional rubber pads. This practically cleared the trouble, although the hum was still audible in the same house.

The hum was finally eliminated completely by mounting the motor on a sheet of ⅜-in. mild-steel, which was allowed to float on a sheet of 1-in. sorbo rubber without any fixing bolts, the belt being tensioned by the weight of the motor.

As a result of these precautions the lathe is almost completely silent when running, almost the only noise now audible in the workshop being the slap of the belt connector, and the welcome sound of the tool cutting when under load.

Yours faithfully,

Wembley Park. K. J. EASTON.

Sawing in the Lathe

DEAR SIR,—For some time past I have wanted a knurling-wheel holder that did not put pressure on the lathe mandrel. So I recently made up the one described in No. 2432 of THE MODEL ENGINEER, page 10, Fig. 3. It has proved an excellent tool. Its construction called for the carving up of several pieces of mild-steel bar, and in that connection I would like to call attention to a real time- and labour-saving tool that I used. I refer to the common slitting saw as used in milling machines. The one I have had in use some years is a 5 in. × $\frac{1}{16}$ in. × 1 in. HS saw, mounted on an old back-axle shaft from a car. It was centred one end and had a ⅞-in. thread and castle nut, was chrome nickel-steel, and cost me one shilling. I left it as long as the lathe would take and mounted the saw dead true on it, and many a job have I done with it. The ability to cut metal true, square, and accurate, in contrast to the hand hacksaw has to be tried to be appreciated. The biggest B.D.M.S. bar I have cut to date is 3 in. × ¾ in., and in the knurl-holder mentioned above, nearly all the machine work was done with this saw. Of course, the work to be cut must be held rock steady in the slide rest or in a good solid two-bolt vertical slide; and, keep the saw well lubricated. Thus equipped, you will soon be wondering what you did without it. The saws are somewhat expensive, but with care will last a lifetime, and they *must* be kept sharp. Any simple grinding spindle will do the job, but be sure to maintain the clearance angle on the teeth as sent out by the makers. In cutting thin stuff, such as model locomotive frames, etc., the material should be backed up with a piece of hard wood, or better still with a piece of scrap metal of a thickness at least equal to the pitch of the saw teeth. This helps to stop chatter, as does also a bit of thick rubber hose slipped over the pin of the driver chuck. Tie the carrier hard against the driver with a piece of string, and keep centres moderately tight. The centre-line of the work-piece should be on the lathe centre-line or else above it, never below. All this sounds involved, but the result is worth it. I can cut 1-in. square mild-steel bar accurately and dead square in three minutes, and that makes the hand saw look sick.

Yours faithfully,

Luton. ERNEST W. FRASER.